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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Higgins
Serial No. 10/797,513
Filed: March 10, 2004
Confirmation No. 4226
For: **METHOD FOR IN-FURNACE REDUCTION FLUE GAS ACIDITY**

Examiner: S. E. Suereth
Art Unit: 3749

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

RESPONSE

This responds to the Office Action dated 10 June 2009 for the above-identified application. The Office is authorized to charge Deposit Account 501923 for a one-month extension of time. If additional Extension of Time or any other fees for the accompanying response is required, Applicant requests that this be considered a Petition therefore. The Commissioner is hereby authorized to charge any additional fees that may be required to Deposit account 501923.

Amendments to the Claims begin on page 2 of this response.

Remarks begin on page 5 of this response.

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claims 1-16.(Cancelled).

17. **(Currently Amended)** A method of operating a combustion system having a stack to lower **an** ~~the~~ acid dewpoint temperature of ~~the~~ **a** flue gas, the method comprising the steps of:

partially combusting the fuel in a first stage to create a chemically reducing environment in situ;

adjusting the reducing environment for a sufficient time period such that the flue gas acid dewpoint temperature is lowered to a temperature lower than the temperature of flue gas traveling through the stack by reducing SO_3 formed during combustion to SO_2 by electron addition; and

combusting the remainder of the fuel and combustion intermediates in a second stage with an oxidizing environment.

18. (Previously Presented) The method of claim 17, including the step of micro-staging the first stage fuel combustion.

19. (Original) The method of claim 18, wherein the micro-staging is provided through the use of low-NOx burners.

20. **(Previously Presented)** The method of claim 17, including the step of macro-staging the first stage of fuel combustion.

21. (Original) The method of claim 20, wherein the macro-staging is provided through the use of over-fired air.

22. (Previously Presented) The method of claim 17, including a combination of micro-staging and macro-staging.

23. (Original) The method of claim 22, wherein the micro-staging is provided by low-NOx burners and the macro-staging is provided by over-fired air.

24. (Original) The method of claim 17, wherein the fuel is coal.

25. **(Currently Amended)** A method of operating a combustion system to decrease the acid dewpoint temperature of its flue gas to a temperature lower than the temperature of flue gas traveling through a stack of the combustion system, the method comprising the steps of:

partially combusting ~~the~~ **a** fuel in a first stage to create a chemically reducing environment in situ;

combusting the remainder of the fuel and combustion intermediates in a second stage with **an** oxidizing environment;

measuring the acid dewpoint of the flue gas;

measuring the temperature of the flue gas traveling through the stack;

if the measured acid dewpoint temperature is higher than the measured flue gas temperature, adjusting the reducing environment for a sufficient time period such that SO_3 formed during combustion is reduced to SO_2 by electron addition to decrease the acid dewpoint temperature of the flue gas.

26. (Previously Presented) The method of claim 25, including the step of micro-staging the first stage fuel combustion.

27. (Original) The method of claim 26, wherein the micro-staging is provided through the use of low-NOx burners.

28. (Previously Presented) The method of claim 25, including the step of macro-staging the first stage of fuel combustion.

29. (Original) The method of claim 28, wherein the macro-staging is provided through the use of over-fired air.

30. (Previously Presented) The method of claim 25, including a combination of micro-staging and macro-staging.

31. (Original) The method of claim 30, wherein the micro-staging is provided by low-NOx burners and the macro-staging is provided by over-fired air.

32. (Original) The method of claim 25, wherein the fuel is coal.

33. (Previously Presented) The method of claim 17, wherein SO_3 concentration is adjusted to about 15 to 20 ppm at an ESP component of the combustion system, thereby optimizing ESP function.

34.(Previously Presented) The method of claim 25, wherein SO_3 concentration is adjusted to about 15 to 20 ppm at an ESP component of the combustion system, thereby optimizing ESP function.

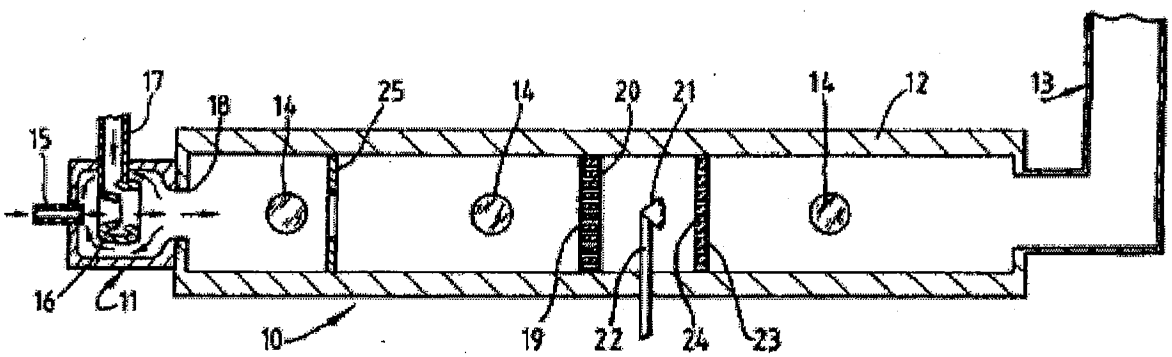
REMARKS

In the Office Action of 10 June 2009, Claims 17-34 were pending with none of the claims yet indicated allowable. Applicant respectfully request reconsideration for the reasons below.

35 U.S.C. § 103 Rejections

Claims 17-34 were rejected under 35 U.S.C. § 103 as obvious over U.S. Patent No. 4,375,949 ("Salooja") in view of U.S. Patent No. 4,029752 ("Cahn"), and in further view of United States Patent No. 4,196,057 ("May"), United States Patent No. 5,011,516 ("Altman"), and Applicant's admitted prior art. Reconsideration and allowance is respectfully requested for the reasons below.

All claims are rejected, at least in part, based on Salooja. It is important to note that, although Salooja discloses a combustion system, Salooja's system is structurally and functionally divergent from methods and systems of Applicant's inventions. Salooja's Figure 1 is provided below for the Office's convenience:



Salooja's disclosure is in reference to small combustion systems having a diameter of about 61 cms and a length of about 127 cms (col. 9, lines 54-57). Salooja experimented with dimensions ranging from 127 to about 190 cms in length and from 12 to 61 cms in diameter. Salooja found that, within such small systems, variances in diameter of a few cms can produce **significant differences** in output results (col. 9, line 66 – col. 10, line 26).

Salooja states that "what has now been discovered is that a far greater reduction in carbon-forming tendency can be achieved by careful design of the combustion chamber" (col. 9, lines 22-25) and that "with a *suitably designed combustion chamber*, in conjunction with a

suitable burner, a clean, highly reducing atmosphere can be generated…." (col. 9, lines 25-28; emphasis added). In short, Salooja is using combustion chamber *design* to generate reducing atmospheres.

Importantly, Salooja's systems are also designed to operate at very low fuel feed rates, e.g., of about 9 to about 11 liters per hour (col. 9, line 66 – col. 10, line 26).

By way of contrast, the current advancements are made in light of vary large combustions systems, e.g., power generations plants (as disclosed in the specification). Power generation plants, for example, are magnitudes of order larger than Salooja's combustion systems in both length and width, and operate with completely different fuel feed rates, volumes and fluid dynamics. For example, power plants commonly burn coal at a rate of 250 tons per hour (approximately 707,921 liters per hour for rough comparison to Salooja's system).

In further contrast to Salooja's combustion systems, where small combustion chambers are easy to replace or produce, large combustion systems are expensive, designed for long-term use, and are not readily replaced or modified. As such, one having ordinary skill in the art would not look to Salooja's small chambers for guidance to larger problems nor would one expect that modifications to a small chamber such as Salooja's would translate to larger combustion systems with any expectation of success.

Nonetheless, Applicant resubmits its previous argument that Salooja teaches away from the claimed methods' *decreasing the acid dewpoint temperature of the flue gas such that it is lower than the flue-gas temperature in the stack.* As noted Salooja discloses that:

> When the fuel contains sulfur, operation with no, or very little, excess air reduces the formation of SO_3, most of the sulfur appearing in the flue gases as SO2 ***with a correspondingly advantageous increase in the acid dew point temperature and potential improvements for additional heat recovery***" (col. 3, lines 26-31; emphasis added).

Thus, Salooja discloses that it is beneficial to *increase* the acid dew point temperature for additional heat recovery.

In response to Salooja's clear teaching away, the Office states that it interprets Salooja's "passage to say that an increase in the levels of SO_2 results in a higher dew point temperature than [a] similar operation with lower levels of SO_2". Applicant respectfully notes that it is unclear as to what "similar operation" the Office is considering or how such a similar operation

would achieve lower levels of SO_2. For at least this reason, reconsideration and clarification is requested.

It additional response to Salooja's teaching away, the Office states that "if Applicant's interpretation of the Salooja reference was correct, there would be substantial sulphuric acid corrosion due to condensing of the SO_3". Applicant notes however that Salooja's combustion systems are not consuming fuel in the same amount as systems for which the instantly claimed inventions were designed. As noted, Salooja is feeding fuel at about 9 to about 11 liters per hour. It would take Salooja's small system approximately 7.3 years of continuous operation to consume the same amount of fuel as a typical power plant does in one hour (707,912 liters at 11 liters per hour = 64355 hours = 2,681 days = 7.3 years).

At Salooja's small fuel consumption rates, it makes sense that Salooja means what it says, and considers additional heat recovery to be more important than small amounts of corrosion caused by SO_3 over long periods of time. Additionally, if corrosion caused a problem in Salooja's system, small exhaust pipes are inexpensive and designed to be easily replaceable, think mufflers for example. For at least the reason that Salooja teaches away from the claimed invention, Applicant requests reconsideration.

As noted previously, the other references are unable to overcome the shortcomings in the Office's primary reference. Accordingly, allowance of all claims herein is respectfully requested.

Conclusion

Applicant notes that because Applicant has addressed certain concerns of the Office does not mean that Applicant concedes other comments of the Office. Furthermore, in the interest of clarity and brevity, the fact that Applicant has made arguments for the patentability of some claims does not necessarily suggest that there are not additional supportive grounds for the patentability of those or other claims.

However, if any issue remains unresolved, Applicants' representative would welcome the opportunity for a telephone interview to expedite allowance and issue.

Respectfully submitted,

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